

**MODULE 8****DIAGNOSTIC TOOLS**

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**REVISION HISTORY**

QRC	P/N-REVISION	INITIATOR	APPROVAL	DATE	CHANGE
			S. Williams	July 1999	Incorporate reviewer comments
A3210	59164 Rev. 1	J. Madarasz	S. Williams	Dec. 2000	Initial Release

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# OVERVIEW

**OBJECTIVE**

To develop Sequoia MSM fault isolation skills, for Customer Engineers, International Distributors, and Biomedical Engineers.

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**PURPOSE**

Providing field service personnel with a conceptual approach for isolating failures and performance problems is a critical part of servicing Sequoia products. Sequoia products benefit from the state-of-the-art diagnostic software tools which can be used effectively given the proper training. These state-of-the-art diagnostic tools are referred to as MSM Tools. Service personnel must be able to operate and understand MSM Tools in order to identify and resolve system service problems in a timely manner.

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## LEARNING MSM TOOLS

### INTRODUCTION

All Sequoia systems are equipped with MSM Tools. MSM is an acronym for Sequoia's Manufacturing, Service, and Marketing menu structure. MSM provides the system operators and service personnel with the appropriate level of access to system features, diagnostics, configuration settings, and Logs. The MSM Tools are accessed at the system User Interface (UI) or remotely via modem by Acuson Help Desk personnel.

The two different levels of MSM diagnostic tools within the Sequoia system are:

- The first level is referred to as the “*User Interface*” level. The User Interface level of diagnostic tools can be accessed by anyone.
- The second level of diagnostic tools is referred to as the “*Service*” level. This level of diagnostics can only be accessed by Acuson trained service personnel.

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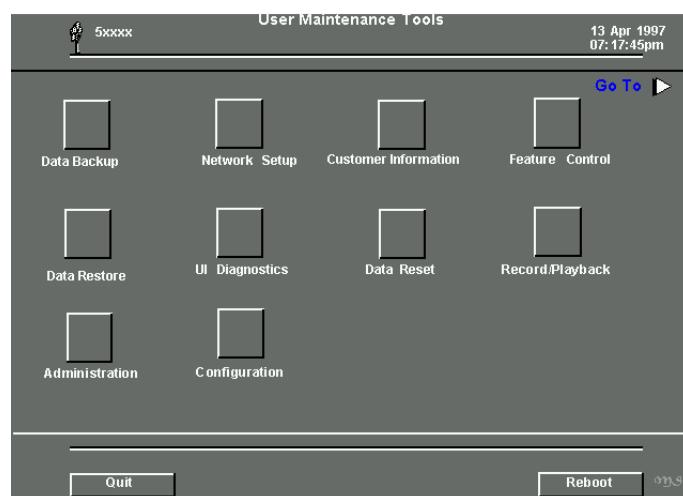
## USER INTERFACE LEVEL

### ◆ To access the User Interface level:

- 1 Press **SETUP** located at the top of the Sequoia keyboard. A pop up menu appears with several options listed.
- 2 Use the trackball to highlight and click on the **UI Service** option in the pop up menu.

A message, **“Starting Service Tool,”** appears on the Sequoia video monitor. In about fifteen seconds, the User Interface Maintenance Tools menu appears on the Sequoia video monitor. Refer to Figure 8-1.

The User Interface level of the MSM diagnostic tools has limited capability. The Service Instructor will explain and demonstrate the access and operation of the MSM diagnostic tools.



**Figure 8-1 User Interface Level Diagnostic Menu**

## SERVICE LEVEL

Service level access is controlled with an *Acuson access number* and *password*. Acuson access numbers and passwords are generated by the Acuson Service Department. Sequoia access numbers are assigned to Acuson trained service personnel by Acuson and are unique to each person that receives them. Access numbers typically do not change once assigned to a system or individual.

Sequoia passwords must be used in conjunction with Sequoia access numbers to gain access to the second level (Service) of the Sequoia MSM Tools.

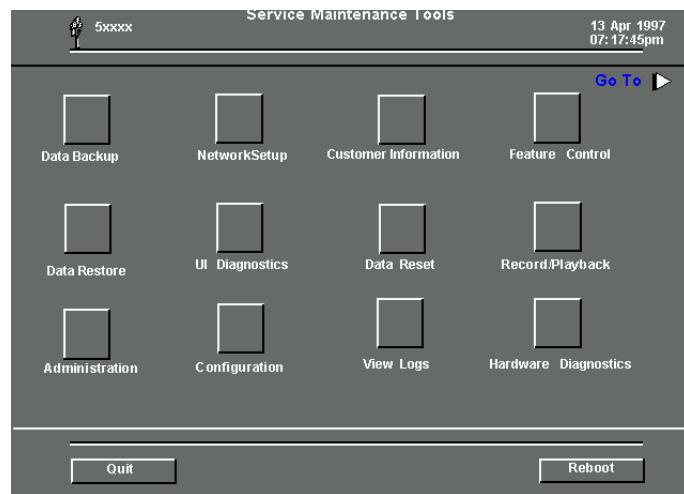
**NOTE:** Sequoia passwords change each day for all Sequoia systems. Sequoia Access numbers and passwords are sent to eligible service personnel via e-mail every five to seven days.

◆ **To access the Service level:**

- 1 Make sure the Sequoia system is powered off.
- 2 Boot to the system:
  - Hold the **MULTIHERTZ®** key up and the **S** key down simultaneously
  - Power on the system
  - Hold the keys in these positions for five seconds
- 3 Release the **MULTIHERTZ** and the **S** keys.
- 4 A message, "**STARTING SERVICE TOOL**", appears on the Sequoia video monitor. Within 45 seconds, the User Interface level diagnostic menu appears as seen in Figure 8-1.
- 5 Use the trackball to highlight and click on the **ADMINISTRATION** icon of the User level diagnostic menu. A menu appears with four different options.
- 6 Use the trackball to highlight and click on the "**ACCESS SERVICE LEVEL**" option. A menu appears with two windows for entering text. These two windows are for the access code and password.
- 7 Use the trackball to click in the access code window. Type in the access code. Note: Any letters in the access code are to be entered in lower case.
- 8 Using the trackball to click in the password window. Type in the password. Note: Any letters in the password are to be entered in lower case.
- 9 Use the trackball to click **OK**. The Service level diagnostic menu appears.
- 10 Use the trackball to click **PRIOR** to return to the Service Maintenance Tools menu, as shown in Figure 8-2.

**NOTE:** The Service Maintenance Tools menu looks similar to the User Interface diagnostic menu except that now icons for View Logs and Hardware Diagnostics appear.

The Service Instructor is to explain and demonstrate how to enter an access code and password to gain access to MSM Tools.



**Figure 8-2 MSM Service Level Diagnostic Menu**

## FRU FAULT ISOLATION TOOLS

Sequoia MSM Tools include a number of diagnostic capabilities to help with FRU fault isolation in the field. These tools include:

- Sequoia system test suites
- FRU fault voting system
- Individual Circuit board test suites
- Sequoia system log files
- Three expert system tools test suites
- Sequoia system audio test software
- Harmony system monitoring software

Along with rigorous troubleshooting and reporting processes, MSM Tools enable service personnel to achieve fault isolation quickly and accurately. The resulting benefits are reductions in troubleshooting time and repeat service calls

# MSM Test Suites

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## Introduction

MSM test suites are designed to achieve maximum system diagnostic coverage in a minimal amount of time. There are three different levels of diagnostic tests that comprise the MSM test suites. There are no repeated or overlapping tests in any of the suites. Each level builds upon each other to accurately determine the cause of any failure. It is vital that lower level suites run before higher level suites to build the proper data foundation for Sequoia's failure analysis software, referred to as "BRAT."

PREFERRED STEPS	TEST SUITES	DIAGNOSTIC COVERAGE
Run this level first	Level 1	90%
Run this level second	Level 1 + Level 2	95%
Run this level third	Level 1 + Level 2 + Level 3	99%

**NOTE:** Remember that Level 1 must always run first, then Level 2, and finally Level 3. Running MSM test suites out of order may result in erroneous failure data.

Additionally, note that all 3 test suites do not have to be run consecutively to find a failure. Failures may be isolated after Level 1 runs, stops, and presents failure data. There may be no need to run Level 2 or 3 at this point. However, to improve confidence in the Level 1 failure data, run Level 2 and 3 thereafter.

**CAUTION!** Shutting the Sequoia system down during or after a test suite results in the loss of current test data. If this occurs, testing must begin with Level 1 once the system is power on again.

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## FAILURE ANALYSIS VOTING

The MSM failure analysis voting system, referred to as “BRAT,” is designed to provide an accurate assessment of the most probable FRU that is at fault when assessing system test failures and performance problems.

**NOTE:** “BRAT” is an acronym for “Bill’s Results Analysis Tool,” taken from the first name of the engineer who created the failure analysis software.

The Service Instructor will explain BRAT voting results and to demonstrate how to initiate Level 1, 2, and 3 test suites.

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## How DOES BRAT WORK?

After each diagnostic suite is run and test failures are detected, BRAT software runs in the background and produces a vote which is associated with a PCB. BRAT software requires no user intervention.

After BRAT has run, a number is displayed next to each listed Sequoia PCB. The PCB with the highest number next to it is most likely the cause of a failure. This is referred to as a BRAT vote. If no failures occur during any of the test suites (Level 1, 2, or 3), no BRAT vote appears. BRAT software typically assigns voting numbers ranging from 1 to 15. The higher the BRAT vote, the higher the probability of a detected PCB failure.

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## SYSFAIL MESSAGES

In addition to BRAT voting and pass fail test results, the Sequoia system may display some test results in a “Sysfail” condition. A Sysfail message indicates that a particular test could not be completed due to an interdependency problem related to another PCB. Sysfail messages can be very useful to service personnel as they may point to the root cause of a failure, i.e. another PCB. Sequoia PCBs use several common busses for communication and work very closely together as a system. Understanding the basic interrelationships between all Sequoia PCBs can be most helpful when analyzing a Sysfail message.

Tests that result in a Sysfail condition may warrant further investigation. Refer to the System Architecture module of this manual to understand and interpret Sysfail messages. It may also be necessary to discuss Sysfail messages and the most probable root cause of a failure with Acuson Technical personnel, such as the Acuson Help Desk.

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## EXPERT SYSTEM TOOLS

### INTRODUCTION

The Expert System Tools (EST) are designed to be used in conjunction with the information obtained by BRAT votes in the MSM Level 1, 2, and 3 test suites. These EST tools are provided to further refine and identify diagnostic failures. The three different EST tools and their coverage include:

TOOL	DESCRIPTION	PCB DIAGNOSTIC COVERAGE	DURATION
BEST	Beamformer Expert System	MX, TX, RX, BF, CN	7 min
PEST	Processor Expert System	RDP, CSD, BDM, CN	5 min
VEST	Video Expert System	IOV, IOE, PIC, FIZ	6 min

These tools use the concept of conditional text execution. If a diagnostic failure shows that a particular system block is bad, the EST does not run any further diagnostics on blocks that are dependent on the bad block in question. This enables the EST to develop a concise idea of which FRU is at fault. Expert System Tools do not use the voting system that Level 1, 2 or 3 suites use. Rather, text messages which discuss the nature of the failures found, along with advice on which FRUs are most likely at fault appear.

The Service Instructor will demonstrate how to access and initiate Expert System Tool tests.

**NOTE:** For any of the Expert System Tools to run properly, Level 1 diagnostics must be run first. Failure to do so results in erroneous EST results.

### BEAMFORMER EXPERT SYSTEM TOOL

The Beamformer Expert System Tool (BEST) is helpful to service personnel as beamformer problems can be quite confusing.

For example, under certain conditions a single channel failure test can cause other diagnostics tests to fail erroneously. BEST focuses strictly on the coherent beamformer section of the Sequoia system. BEST logic is designed to help identify and isolate illusive beamformer failures.

◆ **To initiate the BEST software:**

- 1 Access the Service Maintenance Tools menu by entering the access code and password, as described in "Service Level" on page 8-5.
- 2 Use the trackball to highlight and click on the **HARDWARE DIAGNOSTICS** icon. The available hardware diagnostic test options appear.
- 3 Use the trackball to highlight and click on the **EXPERT SYSTEM TOOLS** option. A menu including BEST appears.

**PROCESSOR EXPERT  
SYSTEM TOOL**

The Processor Expert System Tool (PEST) helps determine if a failure is related to any of the systems main micro-processors. PEST can be helpful with system wide lockups and hang-ups that aren't specifically implicated by other test suites such as Level 1, 2, or 3.

**◆ To initiate the PEST software:**

- 1 Access the Service Maintenance Tools menu by entering the access code and password, as described in "Service Level" on page 8-5.
- 2 Use the trackball to highlight and click on the **HARDWARE DIAGNOSTICS** icon. The available hardware diagnostic test options appear.
- 3 Use the trackball to highlight and click on the **EXPERT SYSTEM TOOLS** option. A menu including PEST appears.

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**VIDEO EXPERT  
SYSTEM TOOL**

The Video Expert System Tool (VEST) helps isolate failures and problems in the video pathway section of the Sequoia DIMAQ workstation. When dealing with problems and symptoms that appear to be related to system video functions, running VEST may help narrow down the possibilities of PCB's which may be causing a problem.

**◆ To initiate the VEST software:**

- 1 Access the Service Maintenance Tools menu by entering the access code and password, as described in "Service Level" on page 8-5.
- 2 Use the trackball to highlight and click on the **HARDWARE DIAGNOSTICS** icon. The available hardware diagnostic test options appear.
- 3 Use the trackball to highlight and click on the **EXPERT SYSTEM TOOLS** option. A menu including VEST appears.

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**INDIVIDUAL BOARD TEST SUITES**

Individual PCB test suites are also available at the service level of the MSM Tools. Individual PCB tests are categorized and grouped by Sequoia PCB name. These Individual PCB test suites include all diagnostic tests that are available for each specific PCB. Each individual PCB test group may be run as a test suite, or tests may be executed individually one test at a time. There is also a provision for looping a single test or tests to aid in the isolation of intermittent PCB failures. Individual PCB tests suites are available for the following Sequoia PCBs:

- MX
- RDP
- RX
- CSD
- TX
- IOE
- BF
- IOV
- CN
- PIC
- BDM

◆ **To access individual PCB test suites:**

- 1 Access the Service Maintenance Tools menu by entering the access code and password, as described in “Service Level” on page 8-5.
- 2 Use the trackball to highlight and click on the **HARDWARE DIAGNOSTICS** icon. The available hardware diagnostic test options appear.
- 3 Use the trackball to highlight and click on the **BOARD TEST** option. A menu containing all of the individual Board Test suites appears.

The Service Instructor will demonstrate how to access and initiate individual board tests suites, specific individual PCB tests, and looping PCB tests.

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## VIEWING SEQUOIA SYSTEM LOGS

All Sequoia systems contain valuable system status information stored as files on a systems' hard disk. These hard disk files are referred to as "Logs." Sequoia system logs are updated frequently by the Sequoia system operating software (OS). Sequoia log information is maintained and retained in system files in a FIFO manner. System logs are retained after power down, hence valuable service information is kept for days. The amount of time that Sequoia system log data is stored varies for each log. This time is dependent on different system conditions such as the log file size, and the rate in which the log data is collected. In general, most logs should contain system data for approximately three days or longer.

Sequoia system logs may be accessed at the system User Interface (UI) or remotely via modem by Acuson Help Desk personnel.

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### LOCATING SYSTEM LOGS

◆ **To locate system logs:**

- 1 Access the Service Maintenance Tools menu by entering the access code and password, as described in "Service Level" on page 8-5.
- 2 Use the trackball to highlight and click on the **VIEW LOGS** icon. The available system logs appear.
- 3 Use the trackball to highlight and click on the specific log to view. The system operating software retrieves and displays the log.

The Service Instructor will demonstrate how to access and initiate individual board tests suites, specific individual PCB tests, and looping PCB tests.

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### INTERPRETING SYSTEM LOGS

Certain Sequoia system logs are stored and displayed in the Sequoia OS format. This operating system format is UNIX Lynx software. The logs which are displayed in UNIX Lynx are:

- System Boot Log
- System Error Log
- System Installation Log
- Service User Interface Log

These logs may be difficult to interpret and understand for individuals not familiar with UNIX Lynx and Sequoia software. To address this difficulty Acuson software engineers have placed a search function at the bottom of the System Boot and Error Logs. This search function can search an entire log for any alphanumeric message that is entered at the Sequoia keyboard.

If the system is experiencing problems, input the search terms “*fatal, kill or sleep*” into the search window. If the system finds these words contained in a log, the line of code containing it appears. The line of software code containing any of these search terms may implicate a specific PCB, micro-processor, or software process that has failed. Also, input search terms for micro-processor names such as: ACP, SSP, SDM and SMM. This type of search may also help identify problems.

Once the search information is obtained, be sure to write it down or photograph it if possible. When this information is recorded, discuss it with a Customer Engineer or Acuson Help Desk personnel before ordering any parts.

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## COPYING A SYSTEM LOG TO A MO DISK

Sequoia system logs can be copied to a MO disk. Acuson Help Desk personnel may request a copy of a system log or logs to assist in the troubleshooting process. Generally, copies of logs are sent to Acuson’s Help Desk so they can be analyzed in their entirety.

### ◆ To copy a log to a MO. disk:

- 1 Format a MO. disk by selecting the **DATA BACKUP** icon in the Service Maintenance Tools menu. Insert a formatted MO disk into the Sequoia MO disk drive.
- 2 Use the trackball to highlight and click the log to copy.
- 3 Click on **COPY**. The log is then copied to the MO disk.
- 4 Repeat to copy additional logs.
- 5 After the log(s) are copied, use the trackball to click on **EJECT** to eject the MO disk.

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## SYSTEM BOOT LOG

The Sequoia system boot log contains information relating to the boot process of the Sequoia system. The boot process normally takes place during each power up cycle, or during the reboot command generated from the Service level of the MSM Tools menu. The boot log contains information on Power Up Test results (PUT Tests), system micro-processor start-up status, and various other OS software conditions. System boot log data can help troubleshoot an intermittent problem or a down system.

The Service Instructor will demonstrate how to access and interpret system boot log data.

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**HARDWARE  
DIAGNOSTIC  
SUMMARY LOG**

The Hardware Diagnostic Summary log stores system hardware configuration information and records the basic results of diagnostic tests that have been run. The system hardware configuration data in this log includes: PCB slot name, PCB part name, PCB revision level, PCB part number, and PCB serial number. The diagnostic test results stored in this log includes the test numbers of diagnostic tests run and the pass / fail status of these tests.

The Service Instructor will demonstrate how to access and interpret the Hardware Diagnostic Summary Log.

**HARDWARE  
DIAGNOSTIC DETAIL  
LOG**

The Hardware Diagnostic Detail log contains the same information as the Hardware Diagnostic Summary Log except with greater detail. The PCB slot name, PCB part name, PCB revision level, PCB part number, and PCB serial number appear just as in the Hardware Diagnostic Summary Log. However, test results appear with more detailed information. Test failure details are displayed in the UNIX Lynx system operating code.

In addition , BRAT votes are also stored and displayed, should any be logged during Level 1, 2, or 3 test suites.

The Service Instructor will demonstrate how to access and interpret the Hardware Diagnostic Detail Log data.

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**SEQUOIA ERROR  
LOG**

The Sequoia Error log actually contains two logs:

- **System Error log.** The System Error log is a list of chronological events that describe the system status. Information such as power up, power down, time duration, hard disk status, stack information, and hardware error events appear.
- **Software Activity log plus Software Error log.** The Software Activity log and Software Error log provide a chronological report on activities such as software power up commands, key stroke commands sent to software code, messaging for errors, and messaging for software warnings.

The Service Instructor will demonstrate how to access and interpret Sequoia Error Log data.

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## HARMONY LOG INTERPRETATION

Harmony refers to the specialized hardware and software that monitors Sequoia power supplies, internal card cage air temperature, PCB fuse status, AC input voltage, and power supply noise levels. The name Harmony is derived from the Acuson term Hardware Monitor. Harmony hardware resides on the PIC board while harmony software and harmony logs reside on the hard drive. Harmony software samples harmony hardware signals approximately every ten minutes while the system is powered up. These readings are stored in a harmony log each time they are measured. The harmony log contains past and present information on power supplies, internal air temp, power supply noise, and AC input voltages, which is quite useful to service personnel.

◆ **To locate a harmony log:**

- 1 Access the Service Maintenance Tools menu by entering the access code and password, as described in "Service Level" on page 8-5.
- 2 Use the trackball to highlight and click on the **VIEW LOGS** icon. The available system logs appear.
- 3 Use the trackball to highlight and click on the **HARMONY LOG**. The system operating software retrieves and displays the log.

The Service Instructor will demonstrate how to access and interpret Harmony Log data.

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## POWER UP TESTS LOG

Power Up Tests (PUT) check Sequoia system hardware each time a system is powered up or rebooted. Power Up Tests appear on a Sequoia video monitor if they fail during a power on or reboot cycle. The Power Up Test Log stores any PUT failures that occur during power up or reboot sequences. If a PUT error occurs, and a Sequoia operator fails to record it, the PUT log can be accessed by Service Personnel to determine which PUT failures have occurred. Each PUT is assigned a number typically ranging from 1 to 30. Each PUT is different and tests different blocks of hardware throughout the Sequoia system. To obtain further data on a specific PUT test, refer to the *MSM User's Guide* provided along with this *Sequoia Training Manual*.

The Service Instructor will demonstrate how to access the PUT Log data.

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## WORKSHEET: MSM TOOLS

LAB	OBJECTIVE	NOTES	SIGN OFF

